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The Seasonality of Wetland and Riparian Taskscapes at Çatalhöyük

Jesse Wolfhagen, Rena Veropoulidou, Gianna Ayala, Dragana Filipović, Ceren Kabukcu, Carla Lancelotti, Marco Madella, Kamilla Pawłowska, Carlos G. Santiago-Marrero, John Wainwright

View of the North Shelter in spring.

Seasonal variation in the natural world of Neolithic Çatalhöyük shaped the organization of daily life and the social world of its residents. Seasonal cycles in climatic patterns, hydrology, growing seasons of wild and domestic plants, and seasonal behaviors of herded, hunted, and gathered animals would have affected the overall productivity of the landscape and consequently the rhythms of social life (e.g., Fairbairn et al. 2005; Pels 2010). These created social conceptions of seasonal patterns and activities shaped the ways in which people interacted with their local environments and structured the timing and spatial requirements of everyday tasks.

In this article, we explore seasonal signals of different tasks associated with the use of local wetland and riparian (i.e., riverbank) habitats at Neolithic Çatalhöyük (ca. 7100–5950 cal BCE). Previous research at the site has investigated seasonality and landscape use within the Neolithic community (e.g., Charles et al. 2014; Fairbairn et al. 2005); here we update these analyses with recent paleoenvironmental and archaeological data focused on the use of wetland and riparian habitats. Neolithic Çatalhöyük's local environments significantly varied in their topography and hydrology, impacting the spatial and temporal availability of wetlands. We investigate how people used local riparian habitats and wetlands to allow insights into the exploitation of the fluctuating affordances of the landscape. Potential changes throughout the site's occupation will be also explored to reveal how environmental and social factors influenced the ways

in which the Neolithic community managed seasonal tasks and opportunities.

Materials and Methods

Seasonality studies are based on the premise that natural resources vary in their availability throughout the year, affecting human activities and decisions regarding tasks. Plants and animals recovered from the site offer seasonally informed signals (e.g., presence of certain plants/animals, dental eruption, chemical composition) that can highlight different seasons of activities (fig. 1; e.g., Halstead 2005). Furthermore, chemical analysis (e.g., stable isotopes) of certain biological materials, such as tooth enamel and shell carbonate, reflect seasonal variation (e.g., Balasse 2002; Versteegh et al. 2010). However, cultural practices such as storage can disassociate the seasonal signal of a resource's use from the season of death/harvest. Thus, while these data can provide insights about seasonal behaviors of exploitation, only contextual arguments can link on-site activities to specific seasons.

A variety of biotic remains excavated during the 2009–2017 excavation seasons at Neolithic Çatalhöyük offer insights into the wetland and riparian taskscapes of its residents. The materials include plant remains, such as charred seeds, charcoal, and phytoliths; domesticated and wild faunal remains, such as animal bones, bird bones, and shells; coupled with stable isotope analysis of oxygen (^{16}O , ^{18}O) and carbon (^{13}C , ^{12}C) in teeth enamel of sheep and cattle; and freshwater mussels carbonate (fig. 2). Recent paleoenvironmental reconstructions provide the backbone



Figure 1. Examples of archaeological data that can provide seasonal signals of activity, showing flotation samples drying, faunal remains from a midden being sorted, a sample of archaeological shells, and a scanning-electron-microscope image of charcoal from an ash (*Fraxinus*) tree. Note that seasonal signals reflect seasonality related to a plant's or animal's life and thus do not directly reflect on-site activities unless other contextual arguments can be made. Photographs by Dragana Filipović, Ceren Kabukcu, Rena Veropoulidou, and Jesse Wolfhagen.

of this study, while previous seasonality studies are also considered (Wolfhagen et al. in press).

Previous Research on Paleoenvironment and Seasonality of Activities

Previous research into the paleoenvironment of Neolithic Çatalhöyük describes an environment dominated by a major spring flood, which would have impacted accessibility to the site and the range of possible activities around the site throughout the year (Roberts and Rosen 2009). In this setting, Fairbairn et al. (2005) stressed the impact that the high groundwater would have had on procurement, production, and processing tasks, and suggested a community that managed subsistence activities.

This paleoenvironmental scenario has been challenged by more recent on- and off-site data. Doherty (2013), working on the use of clay, suggested that drier hillocks of marl soils would have been available near the site rather than extensive backswamps. Charcoal and charred plant remains suggest that crops and exploited woodlands come from a variety of wetland/riparian and dry environments (Asouti 2013; Asouti and Kabukcu 2014; Bogaard et al. 2013; Kabucku, Asouti, and Losh in press). Earlier analysis of strontium isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$) on seed remains and sheep enamel suggested that people herded animals and cultivated crops on the alluvial plain, rather than being forced regularly to use higher-elevation land to avoid large-scale floods (Bogaard et al. 2014, contra Roberts and Rosen 2009). In this framework, Charles et al. (2014) proposed a wider ecological variability near the site, of which people took full advantage, including herding caprines over a wider variety of environments,

selecting crops to suit differences in growing conditions, and traveling more (Charles et al. 2014; Pearson et al. 2015).

The Environmental Setting

The most recent tranche of high-resolution reconstruction of the alluvial landscape further supports the view that Çatalhöyük was characterized by many different environmental niches, as the area was occupied by an anastomosing channel system, which is characterized by multiple (relatively) stable channels that are interconnected (fig. 3; Ayala et al. 2017, in press). The Neolithic Çarşamba River was made up of multiple small channels with intervening higher, drier ground, which, at least initially, were defined by riparian vegetation, which increases bank cohesion. Sediment sequences suggest that this channel belt overlies an earlier, more-wetland channel belt that in turn is above an undulating marl surface (Ayala et al. 2017). The complexity of the subsequent sediment depths and permeability would have created hydrological conditions where seasonal ponding of water occurred near areas that remained more consistently dry through the Neolithic and into the Chalcolithic (see fig. 4 for modern riparian vegetation in central Anatolia).

This paleoenvironmental reconstruction influences ideas about where Çatalhöyük's farmers located their fields and managed the agricultural cycle. Contrary to Sherratt's (1980) suggestion, the vast majority of the cultivated crops at Çatalhöyük appear to have been autumn-sown (Fairbairn et al. 2005; Charles et al. 2014; Filipović 2014). Isotopic analyses of plant remains—particularly $\Delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analyses—show that most crops were grown in moderately to poorly watered conditions (Stroud 2016;



Figure 2. Examples of stable isotopic sampling on an *Unio* shell (18928.S26) and a *Bos* lower molar (13419.S4). Drilled samples from shell carbonate and tooth enamel can be analyzed for $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values that reflect different aspects of past environments and ecologies. Photographs by Rena Veropoulidou and Jesse Wolfhagen.

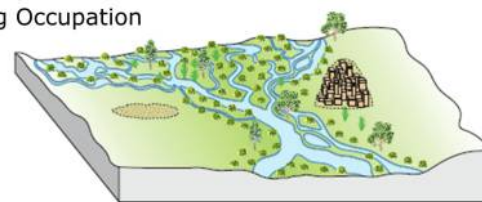
Wallace et al. 2015). Additionally, ecological data on the crop weed taxa show that crops were grown in persistent plots that were intensively managed in dryland environments; seeds from wetland species are associated with animal dung rather than crop processing (Bogaard et al. 2013; Filipović 2014; Green, Charles, and Bogaard 2018). This pattern of land use also varies from earlier settlements in the area, like Boncuklu Höyük, where crops may have been grown in wetland environments (Baird et al. 2018).

This reconstruction of the paleoclimate is not straightforward; recent research suggests the climate was already relatively dry by the start of the Neolithic occupation and became drier over time. Wainwright and Ayala (2019) suggest that the principal driving force in this drying is most likely to have been an increase of summer temperatures. Before autumn rains started, it is likely that soils were desiccated and the water table had dropped dramatically. The hydrology of the Neolithic channels likely responded to climate fluctuations, both morphologically and in terms of flood regime (Ayala et al. in press). Highland areas may have produced a combination of flashy runoff in autumn and winter, and snowmelt in spring, while the runoff in the remaining undulating or low-lying areas may have been more uniformly spread in the autumn and spring seasons. This flow regime would have led to occasional flooding in autumn, and in most but not all years in spring, even in the relatively drier parts of the final phase of the East Mound settlement.

Seasonal Activities in Riparian Environments and Wetlands

This updated paleoenvironmental view of the Çarşamba River system gives further insights into the availability of riparian and wetland habitats, forming the context for revisiting the related available seasonal signatures for major subsistence and livelihood activities. Despite the normative character of these summaries, they call attention to sets of tasks that would have likely occurred at the same time of the year (fig. 5).

During Occupation



Before Occupation

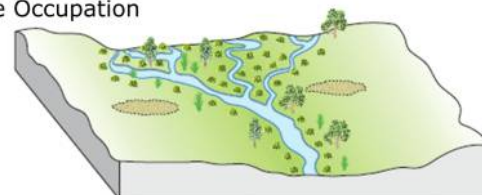


Figure 3. Schematic of landscape development around Neolithic Çatalhöyük before (below) and during (above) the site's occupation based on coring evidence (modified from Ayala et al. 2017 and Ayala et al. in press). The schematic shows the humid anabranching system of the Çarşamba River; this multichannel system became more widespread and convoluted during the site's occupation, creating a mosaic of different habitats around the site including localized wetlands that would have been easily accessible to Çatalhöyük's occupants.



Figure 4. Photographs of modern wetland and riparian vegetation from central Anatolia. The top image shows reeds growing in wetlands of Nar Gölü (Cappadocia), while the bottom image shows a willow growing near Çatalhöyük along a modern irrigation canal. Photographs by Eleni Asouti and Ceren Kabukcu.



Figure 5. Seasonality chart of different activities that would have taken place in local wetland and riparian habitats around Neolithic Çatalhöyük. Months where an activity is more likely to have occurred based on archaeological and paleoenvironmental data are filled in with a deeper color. These gradations are not specifically quantified, however, and months that are blank do not mean that the activity could not have possibly occurred. Furthermore, deeper color does not mean that events like flooding would have been at a greater extent but rather were more likely to occur. Activities are grouped into different thematic groups, with the flooding cycle (blue) separated from various animal-related tasks (red), tasks involving the collection of animals (yellow), and the collection of plants (green).

Reed, Sedge, and Wood Collection

The phytolith record is dominated by stems and leaves of grasses, sedges, and reeds used for the creation of basketry and matting, as fuel, and as inclusions in brickmaking (figs. 6 and 7; Ryan 2013). The different degrees of silicification of phytoliths suggest that harvesting took place throughout their growing season, but certain collection tasks were focused on particular parts of the year: Reeds incorporated into mud bricks were collected in spring/early summer, while other reeds and sedges were collected from August through October (Ryan 2013; Stevanović 2013). The two major pulses of reed and sedges collection are further supported by the age distribution of the micro-mollusk *Valvata piscinalis*, which was likely introduced to the site along with the roots of these plants. The majority are juvenile specimens that would have been found at the end of summer to mid-autumn, while a smaller proportion are older in age mollusks that would have been found during the spring (Veropoulidou in press).

The charcoal data indicate that riparian and wetland woody taxa (e.g., *Celtis*, *Ulmus*, *Ulmaceae*, *Fraxinus*) are dominant on site (Kabukcu 2018). Signs of fungal decay in charcoal samples suggest that people focused on using dry deadwood or seasoned wood as fuel sources. Thus, riparian wood collection was less seasonally constrained, but may have been a regular task for residents going into riparian and wetland environments throughout the year, possibly as a secondary task embedded in other activities (Asouti 2013).

Caprine Herding

A significant portion of the archaeobotanical assemblage represents charred seeds embedded in caprine dung pellets burnt for fuel (fig. 8; Bogaard et al. in press; Filipović 2014). These seeds can be classified into two broad sources of grazed vegetation: marshy to riverine habitats (*Aeluropus*, small-seeded

legumes, *Bolboschoenus glaucus*) that provide seasonal estimates for caprine grazing or fodder collection, and dry/seasonally wet steppe characterized by *Artemisia* and *Juncus* (Bogaard et al. 2013; Filipović 2014). There were also some analyzed samples containing instances of seeds of the likely arable weeds (*Chenopodium*, *Polygonum*) associated with dung, perhaps indicating stubble grazing in late summer or foddering with crop (by-) products (Filipović 2014).

In addition, Henton's (2013) analysis of sheep enamel stable oxygen isotopic values and dental microwear patterns provide direct evidence for sheep grazing in wetter environments and eating wetland plants. Modeled averages of sheep isotopic $\delta^{18}\text{O}$ tooth profiles cluster into two groups, likely corresponding to two kinds of habitats that differ in their aridity. The majority of the sheep average $\delta^{18}\text{O}$ values fall in the lower $\delta^{18}\text{O}$ group, suggesting that these sheep were grazing in well-watered areas rather than the drier steppe. These wetter areas could have been in the riparian zones of the "islands" of the anastomosing river. Similarly, dental microwear evidence suggests that 46 percent of the sheep grazed on wetland grasses or dirty winter pastures (Henton 2013). Different lines of evidence suggest that caprines grazed regularly in local wetlands and riparian environments during the spring through autumn (fig. 9). This strategy may have antecedents at earlier sites like Boncuklu Höyük, as shown through individuals with elevated $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values (Middleton 2018).

Hunting Birds and Mammals

The bird bone assemblage is dominated by ducks and geese that would have been hunted in wetland environments, as well as bones from migratory birds that suggest at least some birding in the winter or spring/autumn migrations (Russell and McGowan 2005). Similarly, the eggshell assemblage is dominated by ducks (Best, Demarchi, and Presslee 2015; Sidell and Scudder 2005).

The majority of eggs were unhatched, thus reflecting collection in the spring through early summer (Best, Demarchi, and Presslee 2015).

According to modelled average enamel and seasonal variation in $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values, most *Bos* appear to have lived mainly in riparian/wetland environments. Hunters may have focused on aurochsen specifically during the rutting season (autumn), when males would have been most predictably located in the landscape. During the Late and Final Çatalhöyük phases, people shifted their focus from aurochsen to domesticated cattle, impacting how people used cattle (fig. 10; Pawłowska 2020; Russell et al. 2013). The pattern of *Bos* enamel $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values however do not change in these later phases, suggesting that these domesticated cattle lived in similar kinds of seasonal habitats as earlier aurochsen and thus possibly followed natural patterns of seasonal dispersal (Wolfhagen 2019).

Red deer, fallow deer, and wild boar also likely lived in riparian environments around Çatalhöyük (Pearson 2013); while these taxa make up only small proportions of the overall faunal assemblage, some potential seasonal patterns of exploitation can be discerned (Pawłowska in press; Twiss et al. in press). The cervid assemblage is dominated by antler, which could be collected

once it had shed in the late winter/spring (fig. 11). Pig remains show an emphasis on infantile/juvenile animals; however, since farrowing can extend across the year, it is difficult to associate these with a specific season (Russell et al. 2013; Twiss et al. in press). Pig remains are rare at Çatalhöyük overall, despite the accessibility of local wetlands. The rarity of pig remains on-site also differs from the earlier community of Boncuklu Höyük, where pigs are a significant component of the faunal assemblage (Baird et al. 2018). This difference may highlight changes in the context of human–boar interactions as part of larger changes in wetland activities, though

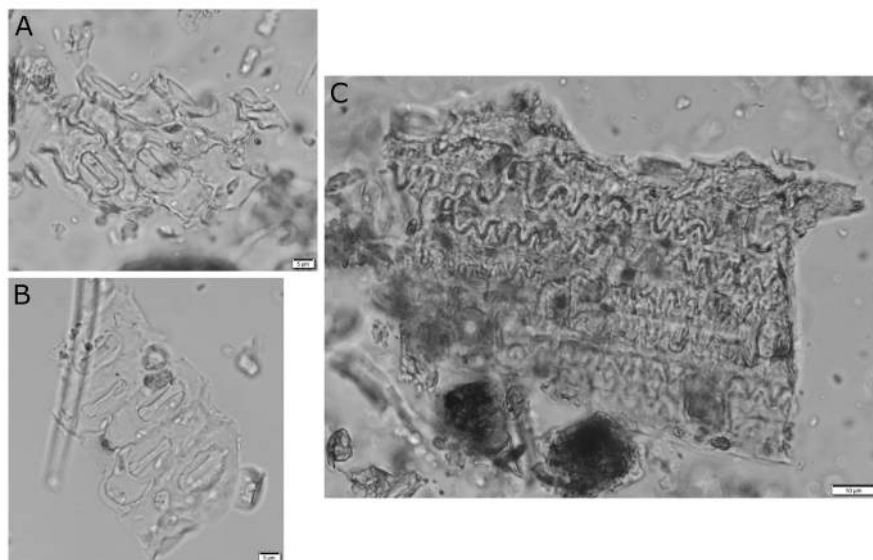


Figure 6. Archaeologically recovered phytoliths from the East Mound's Late Çatalhöyük occupation (South Area, Building 80). Silicified cell structures from reed (*Phragmites* spp.). (A): Completely solidified stomata cells from a mature plant (fully grown). (B): Similar silicified structures at an early formation stage (young leaf). (C): Culm cell's structure. Images at 400 magnification. Photographs by Carlos Santiago-Marrero.



Figure 7. Phytolith impressions of baskets recovered from the East Mound's Late Çatalhöyük occupations (Left: South Area, Building 56, U.12806; Right: North Area, Building 55, 12304.X1). Photographs by Jason Quinlan.

Taxon	Fruiting Months							Life Cycle			Plant Stem Height	Typical Habitats
	April	May	June	July	August	September	October	Annual	Biennial	Perennial		
<i>Bolboschoenus glaucus</i> (Lam.) S. G. Smith	X	X	X	X	X					X	100-200 cm	wetlands and riparian
<i>Sporobolus</i> R. Br.		X	X	X	X	X	X			X	up to 40 cm	
<i>Aeluropus</i> Trin.			X	X	X	X	X			X	9-25 cm	
<i>Juncus</i> L.	X	X	X	X	X	X		X		X	5-150 cm	dry or seasonally-wet steppe
<i>Crypsis</i> Aiton		X	X	X	X	X	X	X			2-70 cm	
<i>Artemisia annua</i> L. type				X	X	X		X	X	X	up to 250 cm	
<i>Leguminosae</i> (small, wild)		X	X	X	X	X		X	X	X	up to 250 cm	generally dry

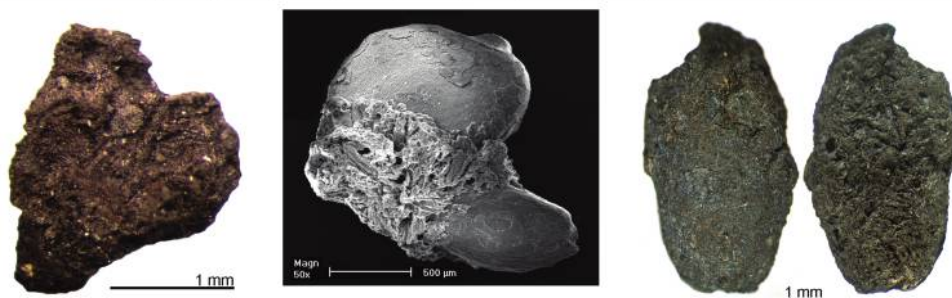


Figure 8. Table of the fruiting months of various wetland-adapted wild plants, showing the months when seeds would have been available for sheep to ingest them. Images show different examples of archaeologically recovered charred dung fragments with seeds embedded in them. Photographs by Dragana Filipović.

may also reflect cultural choices in the appropriateness of boar consumption and/or on-site deposition (Russell 2012).

Mollusk Collection and Fishing

The archaeological shell record is dominated by freshwater mussels (from the genus *Unio*, fig. 12), which were consumed as food, as well as a large variety of other species, many of which were brought unintentionally to the site probably along the roots of riparian plants (Veropoulidou in press). Stable isotopic analysis of mussel shells indicates that harvesting took place in the winter/early spring or from spring-fed lakes in the earlier phases of occupation, while in the later phases the focus shifted to late spring through autumn (Veropoulidou in press).

The fish bone assemblage includes mainly species of the Cyprinidae and Cobitoidea families (Hamilton-Dyer in press; Van Neer et al. 2013) and overwhelmingly dominated by small juvenile fish that must have been fished after the spawning season (late spring/early summer; fig. 13). Mussel gathering and fishing do not necessarily imply immediate consumption, as both mussels and fish could have been dried and stored for later consumption (e.g., Van Neer et al. 2013).

A Seasonal Round in Wetland and Riparian Environments

Wetland and riparian habitats around Neolithic Çatalhöyük were the setting for many activities throughout the year: They were sources of grazing land and wood fuels, of wild foods, of wild

grasses for food and craft, and hunting places for wild mammals and birds. While not an exhaustive list, these activities showcase how people have regularly used these environments within the mosaic of habitats in different seasonal pulses.

Low-level floods regularly recharged the wetland environments in the spring, when people collected wild grasses, mollusks, eggs, antler, and secondarily hunted some migratory birds and possibly farrowed pigs. They also collected reeds for temper in construction materials; perhaps they also cut new wood for storage or collected drying deadwood. It is possible that these spring tasks were embedded in people evaluating the extent of spring floods to determine what areas will be prime areas for grazing and other activities.

Late in the spring or early summer, larger task groups may have fished together using nets and/or traps. During the early summer, most activity in the wetlands ap-

pears to have focused on caprine herding. Other tasks, like digging for mollusks, hunting, or collecting wild grasses, may have occasionally occurred while herding, but it appears that caprine herds may have been moved into riparian environments shortly after the lambing season in the late spring, possibly as a way to move herds away from areas where they could hurt growing crops. Harvesting autumn-sown crops would have made significant labor demands during the early-mid summer, so animals may have been moved to riparian environments to avoid land and labor conflicts with the harvest.

As rainfall picked up at the end of summer into the autumn, there was some potential for smaller floods in the Çarşamba channel belt. People may have focused on collecting more wild grasses, sedges, and reeds for food (edible tubers) and as raw material for making mats and basketry over the winter. Aurochs may have been hunted during their rutting season. Woodland management may have been a particular focus in the fall to prepare stores of winter fuels and browse fodder before shifting attention to preparing fields for autumn-sown crops. Winter would have seen relatively infrequent use of local wetland and riparian environments, though freshwater mussels may have been sought out as supplemental foods. People may have collected these while hunting geese and ducks, whose populations would be at their densest during the winter months.

Diachronic Trends

While the variety of wet and dry environments continued to be available throughout the site's occupation (Asouti 2013; Ayala



Figure 9. Photograph of modern sheep grazing near the Kars River in Kars, northeastern Turkey. Photograph by Jesse Wolfhagen.

et al. 2017; Bogaard et al. 2017), the ways in which people encountered, managed, and used wetlands appear to have changed over the millennia. These renegotiations of the use of wetland spaces was a constant process; Çatalhöyük's residents did not use wetland habitats for plant cultivation, unlike in the earlier Boncuklu Höyük occupation in a similar environment (Baird et al. 2018). These changes may underlie the scarcity of pig remains at Çatalhöyük, as boars would have been less-frequent crop robbers (Baird et al. 2018); though cultural restrictions regarding the consumption and deposition of boar at Çatalhöyük and other later central Anatolian Neolithic communities likely played a role as well (Arbuckle 2013).

Some of the changes to local hydrological patterns and wetland composition may have been due to human activities, such as the changes to the distribution of clay sources (Doherty 2013), or the evolution of the Çarşamba river system (Ayala et al. in press), while climatic change at Final Çatalhöyük phase has also been suggested (Pawłowska in press; Roffet-Salque et al. 2018). Around 6300 cal BCE (the change from the Late to the Final phase), there is a reorganization of sheep management, as herds became smaller and slaughter focused on older animals (Pawłowska in press), while birthing time was shifted into the early spring (Henton in press). Such an arrangement integrates labor better with agricultural production but requires more effort to collect and store fodder for pregnant animals in the winter (Henton 2013).

Phytolith signatures suggest that *Phragmites* reeds become more common in the local environments during the later phases of occupation, suggesting disturbed habitats (Ryan 2013). Taxonomic diversity in the micro-mollusk assemblage decreases

considerably during these phases, as also happens with freshwater mussels and fish (Van Neer et al. 2013; Veropoulidou in press). This decrease could mirror the actual availability of natural populations due to climatic and/or ecological variability (Lewis et al. 2016; Roffet-Salque et al. 2018) or habitat disturbance (Ayala et al. 2017; Doherty 2017), or could reflect a decreased interest in exploiting these food sources (Van Neer et al. 2013). Alternatively, this pattern could represent a change in the types of wetland materials exploited and used or possible changes in the loci of landscape exploitation and variation in off-site activities, such as farming, herding, fishing, collection of plants and woods (Charles et al. 2014).

Other datasets also suggest that the variety of environments people were exploiting changed over the site's occupation. Dung-derived seed data show that "steppic" dung signatures become common in the Middle and Late phases, whereas "riverine" signatures dominated earlier (fig. 14; Bogaard et al. in press). Dietary signatures from stable isotopic samples ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) suggest that sheep, goats, and cattle were grazed over more isotopically diverse areas in the later phases, possibly reflecting changes in herd organization and the inclusion of more graze from drier environments (Pearson 2013; Pearson et al. 2015). Human bone data also suggest increased mobility (Larsen et al. 2019). These data for increased mobility among Çatalhöyük's residents may be in accord with some evidence for increased variability in the seasonal signals found at the site. Migratory bird taxa, predominantly found only in the later levels of the site, possibly suggest that some residents were able to hunt birds during the autumn (Russell 2018), as also happens with *Unio* mollusk collection (Veropoulidou in press). These changes to seasonal patterns may



Figure 10. Abandonment pits (Left: F.7832, Right: F.7833) from the East Mound's Early Çatalhöyük occupation (South Area, Building 160) with aurochs bones deliberately placed around the perimeters. Some elements plausibly articulate between the different pits, though more than one animal was included. Photographs by Jason Quinlan.

be responses to larger renegotiations in the organization and scale of labor, with the possibility of smaller labor groups within the community following diverse subsistence and other strategies (Bogaard et al. 2017; Russell et al. 2013).

Seasonality of Taskscapes

The examination of seasonal activities in wetland and riparian environments around Neolithic Çatalhöyük highlights the role that these environments played in terms of labor budget and economic activity. While agricultural production was obviously a central task for community members and key to navigate their calendars around (Fairbairn et al. 2005), people used the non-agricultural parts of the landscape for a variety of subsistence and craft-related tasks. Some of these tasks, such as fishing or caprine herding, appear to have been seasonally constrained in ways that may affect who could take part in these activities and what other tasks could be going on at the same time. Other tasks, like *Unio* collection or woodland management, may have been pursued and planned intentionally or carried out while fulfilling other needs/activities in these environments. One must consider the makeup of groups that traveled to these environments and the skills necessary to gather these goods successfully and safely.

This admittedly narrow focus on the productive and economic potential of the wetland and riparian environments around Çatalhöyük ignores the social and ritual importance these habitats would have had for community members. The division between strictly utilitarian and socially distinctive products is a false one: Bird wings and aurochs were socially important; wild grasses, sedges, and reeds were used to make storage vessels, funerary baskets, and cordage (e.g., Haddow et al. in press; Ryan 2013). Minor dietary products, such as fish, sedge tubers, mollusks, and birds, may have been fallback foods onto which people relied in



Figure 11. Modified piece of antler base recovered from the East Mound's Middle Çatalhöyük occupation (South Area, Building 89). While the antler base was used as a tool, the preserved base shows that the antler had shed naturally before it was collected in the past. Photograph by Jason Quinlan.

the face of subsistence adversities (Bogaard et al. in press; Van Neer et al. 2013).

Over the course of the site's occupation, people visited a variety of riparian and wetland environments, though the ways in which people organized their activities across the larger landscape changed over time. These changes also occurred within the



Figure 12. An assemblage of *Unio* shells from the East Mound's Early Çatalhöyük occupation (Unit 32692). *Unio* bivalves (freshwater mussels) were collected from freshwater ponds, small lakes, and rivers in the vicinity of the site; the mussels were a food source and the shells were a raw material for artifacts. The isotopic composition of freshwater mussel carbonate generally reflects the values of the waters in which they grew, thus these shells are a useful proxy of past climates and ecology, while isotopic analysis of incremental growth lines can provide information about the seasonality of shell collection. Photograph by Rena Veropoulidou.

larger context of central Anatolian occupation, wherein earlier communities like Boncuklu Höyük were more clearly centralized around wetland exploitation (Baird et al. 2018). Some of these changes may reflect reorganization of labor group sizes. Similarly, interhousehold variability in resource management strategies could have led to more variation in seasonal signals for some activities, such as birding or *Unio* collection. Wider variation in seasonal signals for different tasks may reflect increased freedom for households to adapt to opportunities and challenges in areas that they had control over, producing resilient community-wide practices. In the face of larger changes in social organization related to agropastoral production (Hodder and Doherty 2014), wetlands may have represented areas where people could resist or renegotiate changing social demands.

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Figure 13. Pharyngeal tooth plates of *Pseudophoxinus* spp. recovered from the East Mound's Middle Çatalhöyük midden layer (North Area: Space 490). Bones from this genus and *Capoeta* dominate the diagnostic fish bone assemblage at Çatalhöyük. Species in these genera are small-bodied and are likely to have been caught seasonally using hand nets and scoop baskets in shallow waters. Photograph by Sheila Hamilton-Dyer.

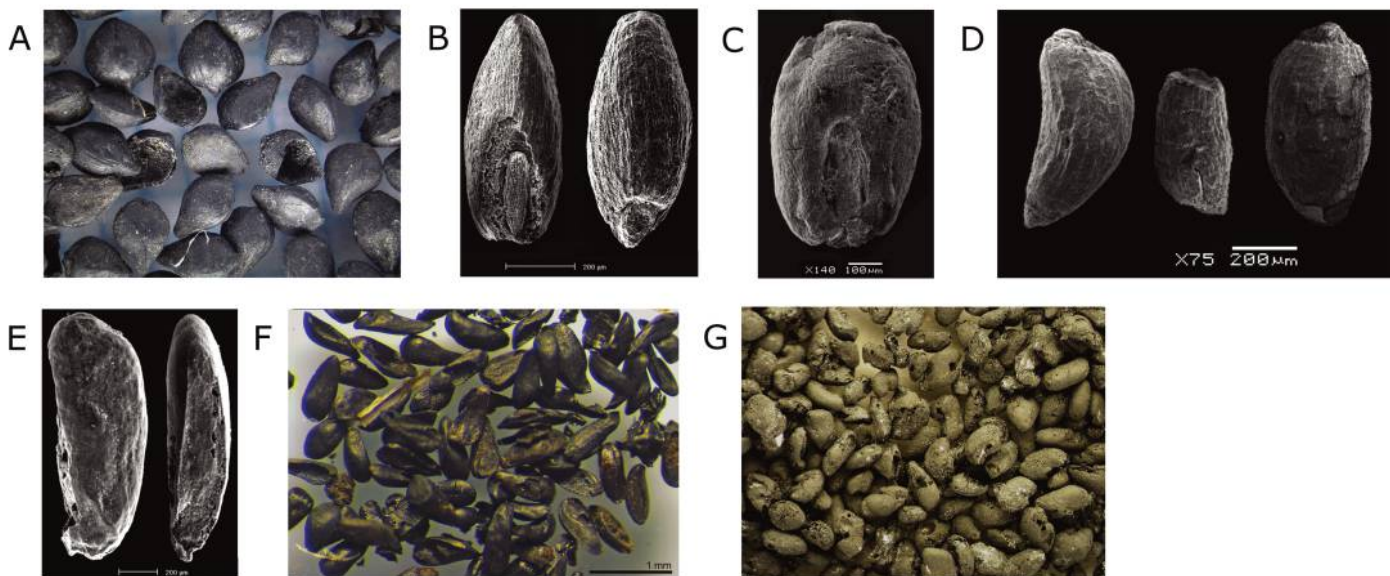


Figure 14. Images of dung-associated seeds from the Çatalhöyük assemblage. The top row includes wetland-related taxa: *Bolboschoenus* (A), *Sporobolus* (B), and *Aeluropus* (C). The middle row includes taxa that grow in dry or seasonally-wet steppes: *Juncus* (D), *Cyperis* (E), and *Artemisia* (F). The bottom row shows various wild *Leguminosae* species (G), which generally grow in dry habitats. Wetland-related taxa are common throughout the site's occupation, while drier ("steppic") taxa are only regularly found starting in the Late Çatalhöyük phase. Photographs by Dragana Filipović.

who have excavated the site over the course of the project's twenty-five years. The ability to bring together disparate datasets at Çatalhöyük is due to the logistical efforts of Dominik Lukas and Christina Tsoraki, while the material could only be studied due to the conservation work led by Ashley Lingle. We also thank the editor and two anonymous reviewers who greatly improved the scope and accessibility of this article.

References

- Arbuckle, Benjamin. 2013. The Late Adoption of Cattle and Pig Husbandry in Neolithic Central Turkey. *Journal of Archaeological Science* 40: 1805–815. DOI: 10.1016/j.jas.2012.12.008
- Asouti, Eleni. 2013. Woodland Vegetation, Firewood Management and Woodcrafts at Neolithic Çatalhöyük. Pp. 129–61 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. London: British Institute of Archaeology at Ankara.
- Asouti, Eleni and Ceren Kabukcu. 2014. Holocene Semi-Arid Oak Woodlands in the Irano-Anatolian Region of Southwest Asia: Natural or Anthropogenic? *Quaternary Science Reviews* 90: 158–82. DOI: 10.1016/j.quascirev.2014.03.001
- Ayala, Gianna, John Wainwright, Jerry M. Lloyd, Joanna Walker, Rachel Hodara Nelson, Melanie Leng, Chris Doherty, and Michael Charles. In press. Disentangling the Palaeoenvironmental Reconstructions of Çatalhöyük. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology Press.
- Ayala, Gianna, John Wainwright, Joanna Walker, Rachel Hodara, Jerry M. Lloyd, Melanie Leng, and Chris Doherty. 2017. Palaeoenvironmental Reconstruction of the Alluvial Landscape of Neolithic Çatalhöyük, Central Southern Turkey: The Implications for Early Agriculture and Responses to Environmental Change. *Journal of Archaeological Science* 87: 30–43. DOI: 10.1016/j.jas.2017.09.002
- Baird, Douglas, Andrew Fairbairn, Emma Jenkins, Louise Martin, Caroline Middleton, Jessica Pearson, Eleni Asouti, Yvonne Edwards, Ceren Kabukcu, Gökhan Mustafaoglu, Nerissa Russell, Ofer Bar-Yosef, Geraldine Jacobsen, Xiaohong Wu, Ambrose Baker, and Sarah Elliot. 2018. Agricultural Origins on the Anatolian Plateau. *PNAS* 115(14):E3077–86. DOI: 10.1073/pnas.1800163115
- Balasse, Marie. 2002. Reconstructing Dietary and Environmental History from Enamel Isotopic Analysis: Time Resolution of Intra-Tooth Sequential Sampling. *International Journal of Osteoarchaeology* 12:155–65.
- Best, Julia, Beatrice Demarchi, and Samantha Presslee. 2015. Avian Eggshell. Pp. 111–15 in *Çatalhöyük Archive Report 2015*. Online: http://www.catalhoyuk.com/sites/default/files/media/pdf/Archive_Report_2015.pdf
- Bogaard, Amy, Michael Charles, Dragana Filipović, Dorian Q. Fuller, Lara González Carretero, Laura Green, Ceren Kabukcu, and Elizabeth Stroud. In press. The Archaeobotany of Çatalhöyük: Results from 2009–2017 Excavations and Final Synthesis. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Bogaard, Amy, Michael Charles, Alexandra Livarda, Muge Ergun, Dragana Filipović, and Glynis Jones. 2013. The Archaeobotany of Mid-Later Occupation Levels at Neolithic Çatalhöyük. Pp. 93–128 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology Press.
- Bogaard, Amy, Dragana Filipović, Andrew Fairbairn, Laura Green, Elizabeth Stroud, Dorian Q Fuller, and Michael Charles. 2017. Agricultural Innovation and Resilience in a Long-Lived Early

- Farming Community: The 1,500-Year Sequence at Neolithic to Early Chalcolithic Çatalhöyük, Central Anatolia. *Anatolian Studies* 67:1–28. DOI: 10.1017/S0066154617000072
- Bogaard, Amy, Elizabeth Henton, Jane Evans, Katheryn Twiss, Michael Charles, Petra Vaiglova, and Nerissa Russell. 2014. Locating Land Use at Neolithic Çatalhöyük, Turkey: The Implications of $^{87}\text{Sr}/^{86}\text{Sr}$ Signatures in Plants and Sheep Tooth Sequences. *Archaeometry* 56:860–77. DOI: 10.1111/arc.12049
- Charles, Michael, Chris Doherty, Eleni Asouti, Amy Bogaard, Elizabeth Henton, Clark Spencer Larsen, Christopher Ruff, Philippa Ryan, Joshua Sadvari, and Katheryn Twiss. 2014. Landscape and Taskscape at Çatalhöyük: An Integrated Perspective. Pp. 71–90 in *Integrating Çatalhöyük: Themes from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Doherty, Chris. 2013. Sourcing Çatalhöyük Clays. Pp. 51–66 in *Substantive Technologies at Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute for Archaeology.
- . 2017. Living with Clay: Materials, Technology, Resources and Landscape at Çatalhöyük. PhD diss., University of Leicester.
- Fairbairn, Andrew, Eleni Asouti, Nerissa Russell, and John Swogger. 2005. Seasonality. Pp. 93–108 in *Çatalhöyük Perspectives: Reports from the 1995–99 Seasons*, ed. Ian Hodder. London: British Institute at Ankara.
- Filipović, Dragana. 2014. *Early Farming in Central Anatolia: An Archaeobotanical Study of Crop Husbandry, Animal Diet and Land Use at Neolithic Çatalhöyük*. Oxford: Archaeopress.
- Green, Laura, Michael Charles, and Amy Bogaard. 2018. Exploring the Agroecology of Neolithic Çatalhöyük, Central Anatolia: An Archaeobotanical Approach to Agricultural Intensity Based on Functional Ecological Analysis of Arable Weed Flora. *Paléorient* 44(2):29–43.
- Haddow, Scott D., Eline Schotsmans, Marco Milella, Marin Pilloud, Belinda Tibbetts, Barbara Betz, and Christopher Knüsel. In press. Funerary practices at Neolithic Çatalhöyük. Part 1: Body Treatment and Deposition. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Halstead, Paul. 2005. Resettling the Neolithic: Faunal Evidence for Seasons of Consumption And Residence at Neolithic Sites in Greece. Pp. 38–50 in *(Un)settling the Neolithic*, ed. Douglass Bailey, Aladair Whittle, and Vicki Cummings. Oxford: Oxbow.
- Hamilton-Dyer, Sheila. In press. Fish. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Henton, Elizabeth. 2013. Oxygen Stable Isotope and Dental Microwear Evidence of Herding Practices at Çatalhöyük. Pp. 299–315 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- . In press. Domestic Herd Management in the Closing 200 Years of Çatalhöyük East, Elucidated through the Combined Use of Oxygen Isotopes and Microwear in Sheep Teeth. In *Late Neolithic at Çatalhöyük East: Excavations of Upper Levels in the Team Poznan Area*, ed. Lech Czerniak and Arkadiusz Marciniak. Los Angeles: Cotsen Institute of Archaeology.
- Hodder, Ian and Chris Doherty. 2014. Temporal Trends: The Shapes and Narratives of Cultural Change at Çatalhöyük. Pp. 169–83 in *Integrating Çatalhöyük: Themes from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Kabukcu, Ceren. 2018. Identification of Woodland Management Practices and Tree Growth Conditions in Archaeological Fuel Waste Remains: A Case Study from the Site of Çatalhöyük in Central Anatolia. *Quaternary International* 463:282–97. DOI: 10.1016/j.quant.2017.03.017
- Kabukcu, Ceren, Eleni Asouti, Joseph Losh. In press. Woodland Vegetation, Fuelwood and Timber Use at Çatalhöyük: The Anthropological Remains from the 1996 to 2017 Excavations. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Larsen, Clark S., Christopher Knüsel, Scott D. Haddow, Marin Pilloud, Marco Milella, Joshua Sadvari, Jessica Pearson, Christopher Ruff, Evan Garofalo, Emmy Bocaage, Barbara Betz, Irene Dori, and Bonnie Glencross. 2019. Bioarchaeology of Neolithic Çatalhöyük Reveals Fundamental Transitions in Health, Mobility, and Lifestyle in Early Farmers. *PNAS* 116(26):12615–23. DOI: 10.1073/pnas.1904345116
- Lewis, Jonathan, Melanie Leng, Jonathan Dean, Arkadiusz Marciniak, Daniella Bar-Yosef Mayer, and Xiaohong Wu. 2016. Early Holocene Palaeoseasonality Inferred from the Stable Isotope Composition of *Unio* Shells from Çatalhöyük, Turkey. *Environmental Archaeology* 22:79–95. DOI: 10.1080/14614103.2015.1116216
- Middleton, Catherine. 2018. The Beginning of Herding and Animal Management: The Early Development of Caprine Herding on the Konya Plain, Central Anatolia. *Anatolian Studies* 68:1–31. DOI: 10.1017/S0066154618000017
- Pawłowska, Kamilla. 2020. Time of Change: Cattle in the Social Practices of Late Neolithic Çatalhöyük. *Archaeological and Anthropological Sciences* 12:39. DOI: 10.1007/s12520-019-00961-x
- . In press. Animals at Late Neolithic Çatalhöyük: Subsistence, Food Processing, and Depositional Practices. In *Late Neolithic at Çatalhöyük East: Excavations of Upper Levels in the Team Poznan Area*, ed. Lech Czerniak and Arkadiusz Marciniak. Los Angeles: Cotsen Institute of Archaeology.
- Pearson, Jessica. 2013. Human and Animal Diet as Evidenced by Stable Carbon and Nitrogen Isotope Analysis. Pp. 271–98 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Pearson, Jessica., Amy Bogaard, Michael Charles, Simon Hillson, Clark S. Larsen, Nerissa Russell, and Katheryn Twiss. 2015. Stable Carbon and Nitrogen Isotope Analysis at Neolithic Çatalhöyük: Evidence for Human and Animal Diet and Their Relationship to Households. *Journal of Archaeological Science* 57:69–79. DOI: 10.1016/j.jas.2015.01.007
- Pels, Peter. 2010. Temporalities of “Religion” at Çatalhöyük. Pp. 220–67 in *Religion in the Emergence of Civilization: Çatalhöyük as a Case Study*, ed. Ian Hodder. Cambridge: Cambridge University Press.
- Roberts, Neil, and Arlene Rosen. 2009. Diversity and Complexity in Early Farming Communities of Southwest Asia: New Insights into the Economic and Environmental Basis of Neolithic Çatalhöyük. *Current Anthropology* 50: 393–402. DOI: 10.1086/598606

- Roffet-Salque, Mélanie, Arkadiusz Marciniak, Paul Valdes, Kamilla Pawłowska, Joanna Pyzel, Lech Czerniak, Marta Krüger, C. Neil Roberts, Sharmini Pitter, and Richard Evershed. 2018. Evidence for the Impact of the 8.2-kyBP Climate Event on Near Eastern Early Farmers. *Proceedings of the National Academy of Sciences* 115(35):8705–9. DOI: 10.1073/pnas.1803607115
- Russell, Nerissa. 2012. *Social Zooarchaeology: Humans and Animals in Prehistory*. Cambridge: Cambridge University Press.
- . 2018. Feathers and Talons: Birds at Neolithic Çatalhöyük, Turkey. *Archaeological and Anthropological Sciences* 11:6393–410. DOI: 10.1007/s12520-018-0681-z
- Russell, Nerissa, and Kevin McGowan. 2005. The Çatalhöyük Bird Bones. Pp. 99–110 in *Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons*, ed. Ian Hodder. Cambridge: McDonald Institute for Archaeological Research.
- Russell, Nerissa, Katheryn Twiss, David Orton, and G. Arzu Demirergi. 2013. More on the Çatalhöyük Mammal Remains. Pp. 213–58 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Ryan, Philippa. 2013. Plant Exploitation from Household and Landscape Perspectives: The Phytolith Evidence. Pp. 163–90 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: British Institute at Ankara.
- Sherratt, Andrew G. 1980. Water, Soil, and Seasonality in Early Cereal Cultivation. *World Archaeology*, 11(3):313–30. DOI: 10.1080/00438243.1980.9979770
- Sidell, E. Jane, and Claire Scudder. 2005. The Eggshell from Çatalhöyük: A Pilot Study. Pp. 117–21 in *Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons*, ed. Ian Hodder. Cambridge: McDonald Institute for Archaeological Research.
- Stevanović, Mirjana. 2013. New Discoveries in House Construction at Çatalhöyük. Pp. 97–114 in *Substantive Technologies at Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Stroud, Elizabeth. 2016. An Archaeobotanical Investigation into the Chalcolithic Economy and Social Organisation of Central Anatolia. PhD diss., University of Oxford.
- Twiss, Katheryn, Jesse Wolfhagen, G. Arzu Demirergi, and Jacqui Mulville. In press. Çatalhöyük 2013–17: The Macromammals. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Van Neer, Wim, Ronald Gravendeel, Wim Wouters, and Nerissa Russell. 2013. The Exploitation of Fish at Çatalhöyük. Pp. 317–28 in *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute of Archaeology.
- Veropoulidou, Rena. In press. The Archaeomalacology of the 2009–2017 Excavations at Neolithic Çatalhöyük. In *Humans and Environments of Çatalhöyük: Reports from the 2009–2017 Seasons*, ed. Ian Hodder. Los Angeles: Cotsen Institute for Archaeology.
- Versteegh, Emma, Hubert Vonhof, Simon Troelstra, Ron Kaandorp, and Dick Kroon. 2010. Seasonally Resolved Growth of Freshwater Bivalves Determined by Oxygen and Carbon Isotope Shell Chemistry. *Geochemistry, Geophysics, Geosystems* 11:1–16. DOI: 10.1029/2009GC002961
- Wainwright, John, and Gianna Ayala. 2019. Teleconnections and Environmental Determinism: Was There Really a Climate-Driven Collapse at Late Neolithic Çatalhöyük? *Proceedings of the National Academy of Sciences* 116(9):3343–44. DOI: 10.1073/pnas.1818336116
- Wallace, Michael P., Glynis Jones, Michael Charles, and Rebecca Fraser, Tim H. E. Heaton, and Amy Bogaard. 2015. Stable Carbon Isotope Evidence for Neolithic and Bronze Age Crop Water Management in the Eastern Mediterranean and Southwest Asia. *PLoS ONE* 10(6):e0127085. DOI: 10.1371/journal.pone.0127085
- Wolfhagen, Jesse. 2019. Rethinking Human–Cattle Interactions at Catalhöyük (Turkey) through Bayesian Analysis of Cattle Biometry and Behavior. PhD diss., Stony Brook University.
- Wolfhagen, Jesse, Rena Veropoulidou, Gianna Ayala, Dragana Filipović, Carla Lancelotti, Marco Madella, Ceren Kabukcu, Kamilla Pawłowska, Carlos Santiago-Marrero, and John Wainwright. In press. The Seasonality of Using Wetland and Riparian Environments at Çatalhöyük. In *Communities at Work: The Making of Çatalhöyük*, ed. Ian Hodder and Christina Tsoraki. Los Angeles: Cotsen Institute of Archaeology Press.



Jesse Wolfhagen, Department of Anthropology, Stony Brook University (USA); Department of Archaeology, Max Planck Institute for the Science of Human History (Germany)

Rena Veropoulidou, The M.H. Wiener Laboratory for Archaeological Science, American School of Classical Studies at Athens; Hellenic Ministry of Culture and Sports (Greece)

Gianna Ayala, Institute for Pre- and Protohistoric Archaeology, Kiel University (Germany)

Dragana Filipović, Institute of Pre- and Protohistoric Archaeology, Christian Albrechts University (Germany)

Ceren Kabukcu, Department of Archaeology, Classics and Egyptology, University of Liverpool (UK)

Carla Lancelotti, CaSEs - Department of Humanities, Universitat Pompeu Fabra, Barcelona (Spain)

Marco Madella, CaSEs - Department of Humanities, Universitat Pompeu Fabra, Barcelona (Spain); ICREA - Passeig L. Companys 23, Barcelona (Spain); School of Geography, Archaeology and Environmental Studies, The University of Witwatersrand, Johannesburg (South Africa)

Kamilla Pawłowska, Adam Mickiewicz University in Poznań (Poland)

Carlos G. Santiago-Marrero, CaSEs - Department of Humanities, Universitat Pompeu Fabra, Barcelona (Spain) **John Wainwright**, Department of Geography, Durham University (UK)

John Wainwright, Department of Geography, Durham University (UK)